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'New Model Office' Project in the Department of Health and Social Security

D. BURDEN, Civil Service Department

Derek Burden is a consultant attached to the Job Satisfaction Studies Team in one of the Personnel Management Divisions of the Civil Service Department. In the article that follows he describes the DHSS 'New Model Office' Project to which he and others have been contributing. —*Editor*

Introduction

For about two years now a small group of people have been working in selected local social security offices of the Department of Health and Social Security (DHSS). This brief article is an attempt to explain how they came to be there and what they are trying to achieve.

Their twin objectives are straightforward:

(*a*) To improve the service given to the public in DHSS local offices.
(*b*) To improve the job satisfaction of staff in those offices.

The background to the work and its perceived need are more complex, and it is necessary first to look at this.

General background

In his article for this journal in August 1973,* my colleague Keith Robertson described in some detail the societal and organizational pressures on individuals and their responses to them. In the two years since that article was written the trends he referred to have continued, and the solutions to problems facing us seem if anything further away.

Keith drew attention to the trends in education: wider subject choice, greater extra-curricular activity, more participative methods in the classroom—all leading to more and more people being better and better educated with consequent aspirations of better and better work to do. He contrasted this with the trends in post-education experience—work experience: larger organizations with more centralized control making the individual—whether as customer or employee—more remote.

Little has been done to narrow the gap between people's aspirations on the one hand and the reality of job opportunities on the other—perhaps even the drive to do so in some quarters has been stemmed by

* *Job Satisfaction in the Civil Service—a Perspective* by K. B. Robertson.

the current economic situation and its consequent employment situation.

Specific background

Early in 1973, Dame Mildred Riddlesdell, Second Permanent Secretary in DHSS, sensitive to the pressure and changes in our society and concerned about the difficulties experienced by local social security office staff in responding to them, proposed that a long-range study be mounted to examine what kind of field administration would be needed for Social Security in 'the 1980s'. An Assistant Secretary (Roger Toulmin) was given this brief under the overall direction of a high-level Steering Group. Specifically the brief was to examine ways of improving the field administration of Social Security to give better service to the public and greater job satisfaction to staff.

The Civil Service Department offered its full support for the study and from here it was only a short step to the Job Satisfaction Studies Team being formally consulted.

Between us we devised a possible approach to the brief which while being unconventional did seem to offer opportunities to investigate and learn more about the problems to which Dame Mildred referred. Instead of the conventional administrative approach of analysing the problem centrally and drafting a set of proposals to meet the expected demands for the next 10 years or so would it not be possible actually to go out to the field and spend some time in local offices not only learning about problems of staff and public at first hand but actually involving staff in understanding those problems and seeking their help to find solutions?

'New Model Office' project

This concept of not only going to the 'grass roots' to learn of the problems, but involving staff in the field in a new way was accepted by the Steering Group on an experimental basis. It should, perhaps, be explained that the rather cumbrous title 'Long-Range Study of Social Security Field Administration' had from the outset been shortened to 'New Model Office' Project—no one in DHSS has ever been able to tell us why! The name has been very much of a mixed blessing: on the one hand, it has misled many into believing that we are trying to create a sort of 'blueprint' office for the future—than which nothing could be further from the truth, as I hope to explain—on the other, the Cromwellian overtones, implying as they do the importance of a change of heart and the 'inner man', are by no means inappropriate.

In order to be totally free to experiment in a local office we felt it necessary to seek room to manoeuvre—both from the Official Side and the Staff Side. From the Official Side we sought freedom from the laid down codes and procedures on the basis that staff in the selected local office would be able to challenge them and would be entitled to an explanation of their *raison d'être*—not just a policy decision. In this way we hoped to begin to free the channels of communication and under-

standing between the executive and policy-making branches of the Department.

From the Staff Side we sought freedom from the demarcation issues within a local office so that local staff might be able to determine the appropriate level of a particular task according to the particular skills and circumstances prevailing.

Armed then with these dispensations we set about the task of finding a suitable 'test bed' local office in which we could persuade the staff to experiment in new ways of working. It must be stressed that for this first office (as for subsequent offices) there was no question of us ' experimenting' unless the local staff were willing to experiment—the choice was theirs—the whole essence of our work (which differentiates it from most other kinds of intervention consultancy) is that of helping people to do things for themselves—*not* doing things *to* people.

We set criteria for the choice of office—among them were the disposition of the Regional Controller and his staff, the group manager responsible for the office, the local office manager, the regional and local Staff Sides and not least the local staff; the geography of the office; the size of the office—and so on. From a short list Swansea local office was finally chosen.

The first phase of our experimental work began in Swansea in October–November 1973.

By Christmas 1973 we had interviewed every member of staff individually, and begun to work with a number of small sections in the office on perceived problems within their work area. During the Christmas holiday period the team took stock of the developing situation at Swansea. It appeared to us that although we could see signs that staff were willing to develop new approaches and challenges to existing work methods and organization there was an inertia about the whole organization which concerned us. Two possible courses suggested themselves—one to spend time working through the issues with management in the office so that they might become accustomed more readily to accept different ways of doing things; the second the more radical step of suggesting a different kind of organization to the management staff at Swansea which would see them as 'advisers' rather than line managers in their own office. We would have preferred the first alternative, but bearing in mind the short time-scale felt that we would have to present the second alternative to the Swansea staff as a possible route forward.

In early January, after these proposals had been discussed with the group manager, local office manager and finally the management team of the office, the proposed change in organization was accepted.

Executive Officers were given responsibility for day-to-day service to the customers, in charge of 'Customer Service Groups', with senior officers acting as advisers. The management team then spent some time working out exactly what advisory groups they should form—the groups decided upon were Technical Service, Training, Personnel and

Monitoring. Whilst working out exactly how their new organization would function the management team began to devise different groupings of staff in the office to provide a better service to the public and after consultation with Executive Officers and other staff in the office an office reorganization was carried out.

By mid-summer 1974 most of the energy for change at Swansea had been consumed in devising and enacting quite a considerable change in organization and layout. As a result many still look upon the activities there as primarily concerning organizational change. The time-pressures upon the team, and the fact that they like the office staff were learning as they went about their work, in a sense made this inevitable. The change from line management role to adviser was too abrupt for most of the management team, particularly as they had no opportunity to learn new skills.

The team certainly learnt a great deal from the pilot work in Swansea, from the mistakes as well as the successes—but had sufficiently demonstrated the possible value of their work to be asked to move on to two more regions of the Department to develop the work further.

The learning from Swansea

The pilot study in Swansea enabled us to identify the following flaws in our approach:

(*a*) By leaning too heavily on our 'experimental' approach we were seen as operating directly from Headquarters in a local office situation. This left the Central Office staff in Wales with a feeling that they were being bypassed and as a result we did not get the support and understanding which we hoped for.

(*b*) The pace of change in the office was forced—as a result many were left behind or felt uninvolved.

(*c*) By removing the management team from direct line command we tended to increase the inertia in the system rather than decrease it—we were in a sense bypassing the problems, not dealing with them.

(*d*) We stressed the code and procedural issues too much with little reward. It is expecting too much of staff used to obeying instructions implicitly to ask them to begin to question those instructions critically—certainly in a short time span. A much more gradual approach is necessary.

Wallsend and Wakefield

In January 1975 a second phase of the work commenced in Wallsend office in Northern Region and at Wakefield in the Yorks and Humberside Region. Two small teams of two people (each with one of the original Swansea team) moved into these offices—joined by a member of the regional staff to gain experience in this work.

To overcome the feeling of isolation which Swansea had experienced the teams spent most of the preceding month in the regional offices explaining to senior support staff what the project activity entailed.

In both offices we were determined to work through the issues arising from staff with the management team *in situ*—there would be no enforced change from outside the office.

In Wakefield the management team spent a week away from the office together in a training session specially arranged and conducted for them by three training staff from the Department's Management Training Centre at Sunningdale. (This was not only a new experience for the management team but for the training staff as well—the opportunity to train a complete management team together virtually in their own environment.)

It is not easy to sum up briefly what has been achieved at Wakefield and Wallsend, but the following may be regarded as the essentials:

(*a*) Staff at all levels have over a period of months actively concerned themselves with analysing and improving their work organization and working methods: examples could be quoted of reorganizations of work; new counter arrangements; more sensitivity to (and concern to find out about) public reaction to the service provided; better relations with local authority social services; imaginative efforts to improve training, personnel management and communications within the office; and various arrangements to evaluate the effectiveness of changes introduced. None of these things of itself is unique; DHSS could point to many other initiatives of a like kind elsewhere. What distinguishes the 'New Model Office' offices is the wide range of innovatory work being tackled under one roof, and the high degree of involvement of all staff from manager to clerical assistant.

(*b*) All this has been achieved with no detriment to performance or output as measured by the Department's standard indicators: it would, therefore, seem that there is little or no short-term cost to offset against the longer-term benefits which are to be anticipated as the logical outcome from staff activity of this kind.

(*c*) Managers, staff and Staff Side in these offices all wish to go on working in this way and, since the departure of the project teams, have continued to develop it as their normal method of operation.

(*d*) For their part, regional management are convinced of its usefulness and are already extending it to two further local offices in each of the two regions.

Outcomes of the work

The work at Swansea, Wallsend and Wakefield has shown beyond doubt that, despite the stresses of social security work, there exists among local office staff at all levels a considerable reservoir of energy, ability, ideas, goodwill and enthusiasm which conventional Civil Service-style management does not adequately tap. The feasibility of tapping it to a greater degree than is usually achieved has been amply demonstrated in these three offices.

We are now able to spell out with some certainty just what it takes

to harness the energies and enthusiasm of staff—and see this as the central task of management toward the goals laid down by Dame Mildred. This is almost certainly the most viable way of improving the quality of service to the public.

There is no short cut to a genuinely participative method of managing. Willing effort and imaginative contribution from staff does not come in response to gimmickry of any kind; it only comes when staff experience the reality of having as complete a job as possible with discretion over how it is to be tackled—and in the knowledge that their managers actually want and value their ideas. Achieving this state of affairs is all too often a painful learning experience for the managers concerned, whose conditioning under the present system has tended in the main to reinforce the mechanical implementation of procedures and instructions imposed from above.

It needs to be emphasized that it is not any particular reorganization or new procedure which brings commitment, but the process of creating it. It is this process which has to be communicated to other offices; which has to be experienced, to be lived through, both for managers and staff; nothing can short-circuit or substitute for the actual experience of beginning to behave in different ways. This experience can only, we believe, be communicated effectively by someone who has himself gone through the entire change process; this means that, at least at the outset, the rate of this progression can only be gradual, depending as it does upon the rate at which the process itself can turn out potential team members with the requisite experience.

Helpful though handbooks and training courses may be there is no substitute for experience in different ways of working. So if it has any meaning at all 'New Model Office' is a concept involving quite different behaviour patterns from the norm, in which staff at all levels are able to give more of their talents towards the service of their public.

Where next?

It is not possible to delineate at the beginning of a project exactly where the process will lead, but this very open-endedness helps to guarantee a different quality of experience. Already the studies have proved that it is possible to experiment without courting disaster and without disrupting operational activity. The next step is to ensure that our developing activities become on-going, that they are no longer seen as something separate from or additional to the normal management task, but integral to it.

There is a great deal more to be done if the Civil Service is to tackle its most pervasive problem—that of under-utilization of talent; if tasks to be done are to be brought more into line with staff aspirations. With the 'New Model Office' we feel we have made a start and at least sharpened the awareness towards these issues of both the Official Side and the Staff Side; perhaps even begun to discover some possible ways forward.

A System of Models for Planning Highways Expenditure

Dr. K. ALDRED and B. L. GLICKSMAN, Civil Service Department

The authors worked on the development of the system of models described in the article that follows. Keith Aldred is now on loan to the General Expenditure Analysis group in the Treasury, and Brian Glicksman on secondment to the Highways Directorate of the Department of the Environment. —*Editor.*

The problem

Introduction

The planning and control of public expenditure has become increasingly important and complex. It was sufficient at one time to ensure that money was spent only for the purposes specified, that no more was spent than budgeted and that funds were not misappropriated. With the expansion of public expenditure over the last 20 years to constitute around half the National Income of the United Kingdom it has also become essential to consider and control the economic effect of public expenditure and to ensure that this expansion leads to the greatest public benefit.

Overall planning and control of expenditure is the responsibility of the Treasury, but can only be achieved if it is supported by planning and control of individual expenditure programmes by the Departments responsible. The system described here was devised to assist the Department of the Environment in the planning and control of expenditure on highways construction. Decisions affecting expenditure take place in many areas over a considerable period of time, so the study was limited to a specific area where difficulty had been experienced in the past, that of forecasting and controlling the amount of expenditure over the next five years. The work described was not concerned with the initial choice of road schemes thought worthy of construction in the light of their expected benefits, or in measures to ensure that the road required is designed and constructed at the least cost.

History and background

Early in 1970 the interests of three Departments in this area came together. A team in Treasury was investigating a number of areas of public expenditure, in particular capital expenditure, with a view to improving forecasting; the Management Services (Operational

Research) Division, Civil Service Department was interested in the use of mathematical models for forecasting and planning public expenditure; and the then Ministry of Transport, now the Department of the Environment, which had already computerized some information on the road building programme was interested in developing the range of management information available on the road programme with a view not only to better forecasting but also more effective management of the road programme.

A joint MOT/CSD team was set up in 1970 which recommended a computerized system comprising three main areas: an accounting system for the roads Vote, a data base of information on road schemes and the mathematical forecasting and planning models. All three are now operational.

The accounting system replaced the previous mechanized and manual system for maintaining the Vote and scheme accounts. The scheme data base contains factual information on the nature of each scheme, such as its length and location. It also holds forecasts of the costs of the schemes and of the dates on which the schemes will reach certain key stages in their preparation. The integration of these functions in the one system has eliminated the need for overlapping data collection systems providing similar information for different purposes. As well as being of value in their own right, these aspects of the system provide the basic information for the forecasting and planning models and the historical information with which they can be up-dated. The purpose and design of the models are described in the following sections.

Nature of the forecasting and planning problem

The initial examination of the problem indicated that it had related elements of forecasting, planning and control. A number of inherent uncertainties, both in the nature of the road design and construction process and in the environment in which it is carried out prevent accurate forecasting. These forecasting difficulties lead in turn to difficulties of planning and control. In addition, there is an inertia within the system which affects the degree to which control can be exercised.

The design process may be conveniently described in three stages corresponding to the administrative status of the scheme at each stage. A road scheme begins its life in terms of a broad idea, for example, to improve the road between town A and town B or to by-pass a particular village or small town. In this state schemes are introduced into the 'Preparation Pool'. Schemes which are less well defined, often because they cover a greater distance, may be the subject of an initial feasibility study.

In the Preparation Pool the schemes undergo a preliminary design process. A preliminary report is submitted for approval by DOE Headquarters and more detailed design can then continue following which a

Firm Programme Report is submitted. With the approval of this Report the scheme is given a date at which it is hoped work might be able to start, but this date, like most forecast dates in the preparation process, is invariably optimistic. Following Firm Programme approval, detailed design can then continue. In parallel with this detailed design, statutory procedures are carried out. These comprise Line Orders to determine the line of the road, Side Road Orders to determine alterations to adjacent roads, and Compulsory Purchase Orders for land which is impossible to obtain by private agreement.

With the design and statutory procedures completed, the scheme is submitted again to DOE Headquarters for works commitment approval. This is, in normal circumstances, the final financial approval before the scheme is allowed to go ahead into the construction phase. Once approval is given, tenders may be invited. On receipt of the completed tenders, a contract is let, normally to the lowest tenderer, and work may then commence.

The whole process from the entry of a scheme into the Preparation Pool to the start of work typically takes seven years. As design work proceeds, natural features may become apparent which demand a change of plan and, therefore, involve delay. In addition, particularly with the increasing public opposition to new road schemes, statutory procedures and public consultation involve a considerable time and effort and may even involve a major change of plan. As the statutory procedures occur at the end of the design process these delays cause particular difficulties for forecasting.

Once a contract has been let construction work starts within a month or two and for a large scheme usually takes 24 months. It is during the construction process itself that most of the money paid on a scheme is spent, in the form of progress payments to the contractor. Factors such as the weather, unexpected difficulties in construction, or the performance of the contractor affect the ability to forecast the flow of expenditure accurately.

These difficulties in forecasting of themselves cause difficulties in planning and control, but additional difficulties arise from the inertia which is inherent within the system both in the design and the construction processes. To some extent design work can be speeded up at the expense of other schemes by the redeployment of manpower but it is difficult if not impossible to speed up statutory procedures. In the construction phase, it is in practice impossible to influence the rate of progress of schemes already under construction. Since the schemes have a construction period of typically two years, most of the expenditure in any financial year is on contracts which have been let before the year has started. Hence the margin for changing the expenditure by controlling the rate of start of new schemes is severely limited.

The process of road construction described above can be considered to comprise two separate phases: a design phase followed by a construction phase. The two phases are linked by a key decision at the works

commitment stage, which represents the final financial approval of a scheme after which construction normally goes ahead without further detailed consideration. Although works commitment is not the last stage in the design process it normally occurs within five or six months of start of work. For forecasting purposes the system can, therefore, be described by two separate sub-models, one to represent the design process and the other to represent the construction process. A separate model is required to determine the most appropriate control measures to meet desired criteria, by means of a form of 'dialogue' between the administrator and the model. These three models are described as the *design model*, the *construction model* and the *dialogue model*, respectively.

The models

Design model

The main purpose of the design model is to forecast the works commitment and start of work dates of a road scheme and estimate the cost of the scheme at that date. The model is, however, sufficiently general to be used for forecasting the date of any of the main stages in the design process, and also allows analysis to be performed showing the sensitivity of the results to changes in the predicted rate of progress or the predicted change of estimated cost.

Estimates of the time when key stages will be reached are made by the engineers in charge of each project. A comparison of these forecasts with the outcome shows, in common with many similar situations, that such estimates are optimistic and do not allow sufficiently for the delays and difficulties which occur. The relationship between the engineers' estimate and the outcome is nevertheless consistent, and represents a good reflection of the amount of work remaining to be done if things go smoothly. The more work there is to be done, the longer is the allowance that should be made for delays and the higher is the likely error in the forecast. The design model adjusts the engineers' estimates using probability distributions calculated from historical data which relate the subjective estimates to actual outcome. The distributions used depend on the type of road being built, the arrangement under which design is being carried out (direct or agency) and the stage of preparation already reached.

It is recognized that this method of forecasting is susceptible to changes in the estimating behaviour of the engineers, and that these need to be detected by monitoring the 'slippage', or change in the engineers' forecasts over time. The sensitivity of the results to changes in the accuracy of engineers' forecasts can be tested by varying the degree of discounting applied to adjust for the engineers' optimism by any desired factor and by varying the degree of spread applied to the forecasts. The factors can be applied to all or only a sub-set of the schemes. Similarly the effect of any degree of change in the forecast cost of a scheme (in real terms) can be investigated. Analysis of the change in the real cost of schemes during their design has not given any

reliable guide to the degree of change which should be allowed for, but these changes, which occur for a variety of reasons such as changes in design standards (for example, the introduction of crash barriers or technological improvements which reduce construction costs) make it important to carry out this form of sensitivity analysis.

After initially working well, the design model has presented some difficulties following the successive cuts in the road programme which have been made since 1973. These cuts have resulted in many schemes being postponed. It was anticipated that such postponements would occur at the works commitment stage, where they could be specifically allowed for in the system of models, as this was treated as the main decision point. In practice, both deliberately and as a natural reaction of the engineers preparing the schemes, postponements have occurred at earlier stages in the preparation process and at the point of letting the contract. The programme written to analyse past slippage is unable to distinguish between postponements due to slippage and postponements made deliberately because of expenditure cuts. Even if such a distinction were possible, the extra time which is now available for the preparation of the postponed schemes means that slippage in the future may not be as great as in the past and therefore past analysis may not be valid for the future. This makes all the more important the ability to test the sensitivity of the results to alternative slippage assumptions.

The full range of problems in the design phase is, in fact, wider than was attempted in the design model. Ideally a model of the design phase of a scheme should be able to predict the time taken for the various constituent activities, given the number of staff employed. Such a model could be used to schedule design staff on to schemes in order to control the flow of schemes coming forward for works commitment to some desired pattern. This development must await further research.

Construction model

The construction model usually forecasts payments for the current and the next year's estimates, or the five-year period covered by the Public Expenditure Survey. By far the largest component of expenditure is payment for construction works and the model concentrates on this, but payments for land are also forecast.

Analysis of the pattern of payments on completed schemes showed a strong seasonal variation. When this was removed the underlying pattern of expenditure was found to be fairly constant throughout most of the contract period, with a build up over the first few months of the contract period and a tailing off over the last few months, irrespective of the length of the contract. The proportion of the total cost of the works paid by the end of the contract period was found to be remarkably consistent. Sensitivity analysis showed that the payments forecast was very sensitive to the contract period and the proportion of payments made by the end of the contract. This determined the form

of the forecasting model, which treats each scheme separately and derives a payment profile for that scheme determined on the basis of its contract period and the time of year at which it starts. The forecasts made for each individual scheme cannot, naturally, be expected to be very accurate, but when subsequently aggregated they have produced better forecasts than trying to forecast schemes in blocks already aggregated. Forecasting the schemes individually also allows each scheme to be repriced individually on any desired basis before aggregation. This allows complex problems of price adjustment to be overcome.

The construction model is intended in the first instance to forecast payments using the results of the design model. It will be clear from the previous section that in many circumstances forecasts of payments are required on the basis of a desired set of starts rather than a forecast set of starts. The model was, therefore, designed to be sufficiently flexible to accept both starts data and cost forecasts from sources other than the design model. Any set of starts data and cost forecasts can be inserted by the user either in the form of a list of forecasts, or in the form of a systematic adjustment of forecasts of a particular type.

Dialogue model

The design and construction models, although they allow some testing of options to be carried out on a 'trial and error' basis, are essentially forecasting models. They provide a base forecast of the expenditure which will flow from current plans if these are allowed to go ahead, but are unlikely, even after repeated attempts, to give the best plan to meet certain conditions, e.g. to restrict expenditure in circumstances of financial stringency. The dialogue model was designed for this purpose.

In controlling the road programme DOE aims to hold expenditure within the limits agreed with the Treasury, while at the same time keeping to a minimum delays to the schemes considered of greatest priority. None of the criteria involved in meeting these aims is rigid. The acceptable degree of delay, the relative importance of schemes and the expenditure limits must be balanced against one another with a knowledge of what a change in one does to the others. The dialogue model was designed to do this using a linear programming formulation in which the expenditure limits were represented by constraints above and below the public expenditure ceilings, between which expenditure was required to lie, and the objective was to minimize delay to schemes at the works commitment stage weighted according to priority. This approach proved difficult to implement and so an alternative model has been developed to indicate the measures needed to control expenditure.

This model ranks schemes according to subjective criteria and uses a 'rule of thumb' to suggest which schemes should be delayed, and by how much, to meet the expenditure allocations. The results will not be 'optimum' but can form the basis of discussions to arrive at an agreed programme of starts.

Conclusions

Use of models in practice

The models have now been in use for over two years and the accuracy of payments forecasts seems to have been considerably improved. In addition, forecasts on a variety of possible bases can be obtained much more quickly than before. Whereas it might take several weeks to calculate a forecast using the previous manual methods, forecasts can now be produced often within a matter of hours, constrained only by the time necessary to type the required data into the computer.

The computer programs were designed as flexibly as possible, being composed of a number of small units which may be easily amended, by-passed or added to, to meet the changing needs of the system. This flexibility has been tested and proved in many ways. For example, the construction model was invaluable at the time the expenditure cuts of December 1973 were under consideration. It was used to show the expenditure arising from different groups of schemes and the consequences of starting or delaying particular sets of schemes. For some of these options new sub-routines were required for the computer programs or the existing programs needed to be rearranged in a new way. In most cases, even when some computer programming was required, the changes could be effected and new forecasts produced within a few days. A genuine dialogue was able to take place between the administration and the model, with the assistance of a specialist, and the intention of the models was fulfilled.

Role of the 'Information Team'

In the early stages much of the use of the models has depended on the presence of a highly trained specialist who has been able to operate the models for the Highways administration to make maximum use of flexibility available and to make rapidly such changes and developments as were seen to be necessary. It is not anticipated that, when the model is settled into more normal use, it will be necessary to have such a highly experienced specialist, but a specialist will still be necessary. The size and complexity of the road programme justified such a specialist but, in other expenditure programmes, models may be required for which specialist-operating expertise can be dispensed with.

Integration of the models with the data base

When the project for the development of the Highways Management Information system was first started the association of the forecasting and planning models with a new data base of information on schemes and a computerized accounting system was thought to be a considerable advantage. At that time the existing data base was felt to be deficient in a number of ways which resulted in poor forecasts and a new data base with better sources of data and better validity checks was expected to produce considerable improvements. In addition, this data base collected information on expenditure on schemes which was also

available through the manual accounting system operated at that time. Clearly collecting the same data twice was wasteful and the inability to reconcile the two sets of figures led to a lack of confidence in the data used for forecasting.

As the new data base has developed it has been found necessary to make a number of compromises between the requirements of the model and the requirements of the other users of the data base, particularly the requirement to provide an accurate accounting record. The data processing and the model requirements of the computer system were found to differ in a number of respects. For speed and ease of operation the model requires on-line access to the computer via terminals, whereas for data processing requirements, batch processing is adequate; the models require fast computational ability with floating point as well as integer numbers, whereas this facility is not important for data processing; the model operates more rapidly on unformatted and numerical files, whereas for data processing readable formatted files are preferred and the structure of the model is such that serial access to the files is most appropriate, whereas for data processing a random access file was preferred. Although the data from the new data base are fed to the model system, overcoming these problems has resulted in an almost complete separation of the model and data processing systems.

Value of the study for public expenditure forecasting

Although designed primarily for use with the road construction programme, the model was designed with an eye to possible use in other areas of construction work. Experience so far has shown the transferability of the model to be limited but possible, administrative differences between different areas causing the most important difficulties. Many construction areas are not controlled directly by central Government but by local authorities or other authorities with delegated powers. This disturbs the cohesion of the planning and forecasting aspects of the models. More generally the knowledge gained of the nature of forecasting problems in construction work has been very useful and it is hoped to use both the more general knowledge gained and the specific tool of the models in the development of better forecasting in other construction areas.

Use of the models has also provided some insight into the degree of inertia in public expenditure and conversely the amount of public expenditure which is readily available to adjustment. This provides an indication, for example, of the limitation of counter-cyclical action or expenditure cuts and the degree of adjustment necessary in order to achieve certain expenditure objectives. More generally, work within a department on forecasting an area of public expenditure has shown something of the psychology of the relationship between Treasury and Departments, and the limitations this sets on the accuracy of expenditure forecasting. So long as there is an element of Treasury control in

this relationship it seems unlikely that, however good the Department's forecasting methods, it will ever submit forecasts to the Treasury which are as likely to be too low as too high.

Experience

Consultants were employed for the detailed development of the present suite of programs, since 1972. To a decreasing extent they have been employed ever since. The development of the suite to adequate 'live' operation at the end of 1974 cost about £200,000 in fees and computer time. Its current running cost amounts to £11,500 per month. The operation of the forecasting models, as distinct from information services and accounting, absorb about 20 per cent of this.

DOE hardly appreciated how expensive and difficult it would be to develop and maintain a computer suite as complex as they now have. Intending developers of model systems linked to a large data base must consider very carefully whether they have the staying power to force their models to a successfully working stage and even whether they have the power to collect adequate information to support them.

Experience of the technical problems leads to the conclusion that the development of the model should be an evolutionary process. In the early stages of this study the existing data were dismissed as being inadequate, but when at a subsequent stage it became necessary to use this data nevertheless, it was found that a large part of the benefit of the study could be obtained without any additional data collection at all. Similarly, by first building a very simplified model and trying to use this, the more important areas for future development became apparent in a way which they would not have done without this experience.

For the model to be able to evolve in this way it needs to have a modular structure, that is it should be built from units which can be readily replaced and related to one another in different ways. Further, the model is best designed as representative of the system under control rather than a more abstract formulation, and this assists communication between the administrator and the analyst by ensuring that the model is easily understood, as well as assisting flexibility. The model should contain the relevant decision variables so far as these can be ascertained and it should be quickly and readily operated.

Development of models in this way has implications for project management, for in an evolutionary project it is not easy to say at the start how long the project will take, how much effort will be involved and what the benefits will be. One might even go so far as to describe the process of modelling as an education process rather than a research and development process, the outcome being that a group of administrators working in a particular area now have at their disposal a new way of tackling the problems with which they are faced rather than a black box which provides all the answers.

This 'education' philosophy lies behind the increasing number of

'model building systems' apparently being sold, particularly by computer terminal companies and management consultants in the private sector for industrial managers to use to build their own models. While it is clear that there will never be enough analysts available for one to be associated with each suite of models in the manner proposed at DOE, to suggest that administrators should build as well as operate their own models without assistance from professional analysts is to go too far to the opposite extreme. However, these model building systems, particularly if certain of their technical deficiencies can be overcome, may provide a useful language for co-operative model building by administrators and analysts together.

It is the authors' view that the approach described here is fundamental to the successful use of mathematical models to assist managers both in government and in the private sector whether a particular package is used or not.

The Simpson Collection

Readers of *MSIG* may like to know that Sir John Simpson who played a leading part in setting up O & M in the Civil Service—he was an early Director of Treasury O & M—has presented a number of relevant books to the Civil Service College library (London Centre). Many of the books were inscribed personally by the authors, now well-revered names, to Sir John and it seemed appropriate to keep the books in a separate group, to be known as *The Simpson Collection* as a small tribute to Sir John's work in the O & M field. Sir John has agreed to the suggestion.

The books are, of course, available to staff in Government Departments from the College library and may well be of interest to anyone engaged on research in O & M, as well as in normal O & M assignment work.

The Project is Dead! Long Live the Project!

D. W. CROISDALE, Civil Service Department

Derrick Croisdale is Head of Automatic Data Processing training in the Civil Service College. In the article that follows he expresses some personal views. —*Editor.*

Institutional dinosaurs

The computer is known to be an agent of change. Many people have experienced a change in their working lives as a result of computerization. Too few have regarded the change as beneficial to themselves, to the organization in which they work or to society at large. Mostly the change is accepted with resignation, frustration, irritation or as inevitable in the wake of technology.

However, until relatively recently it was not widely acknowledged that computer-aided administrative systems would themselves prove to be highly resistant to change. We have created—and may be continuing to create—institutional dinosaurs at a time when to survive demands institutional adaptability. The rate of change in all aspects of contemporary society is greater now than at any time in man's history—and is likely to increase. It is what Alvin Toffler calls 'transience' in his book *Future Shock*.[1]

How we came to create unadaptable computer-aided systems is worthy of analysis to provide guidelines for the future.

Analysis of developments 1958–65

In this period we created the first generation of computer-aided administrative systems. They were designed and implemented mainly by people with considerable experience in what the author calls the host system.[2] The designers had worked in the functional areas concerned and many of them were O and M practitioners.

Two features of this era are relevant to the analysis. Both were desirable in themselves yet ensured that a course was unwittingly set destined to take many a system into very dangerous waters. One was that 'cost-effectiveness' was adopted by the Treasury for the purposes of financial approval. This by itself appeared not only innocuous but laudable. However, it did have the effect of compelling departments to present their cases for financial approval on the basis of monolithic proposals—because a phased approach to computerization was less likely to show the required financial return over the required term than an all-embracing scheme in which all the savings and benefits could be

claimed within the prescribed period. This tendency towards unity of design ensured that 'bigness' would also characterize our systems and together they ushered in the second main feature—the adoption of project-management as the style of management to be used for designing and implementing these large computer-aided systems. This style of management was imported into administrative organizations from civil and industrial engineering organizations which had long used it for building bridges, factories, etc., or for introducing new products.

These features, praiseworthy in themselves, meant that for the next decade or so we were to be burdened with the design and implementation of big monolithic systems—and worse, with attempting to maintain, develop and later convert them. The belief in the 'rightness' of large monolithic systems was supported by the belief that a large computer system was more cost-effective than a number of smaller systems of equivalent cost. This latter belief was founded upon the much misunderstood, misused statement which became known as Grosch's Law.[3] The law appears to hold good only for 'number-crunching' computers.

1965–75: Consolidation of project methodologies for large monolithic systems

Centralization and bigness have dominated the data processing applications in this decade. The project management methodology that has become firmly established is a simple linear methodology in which the following sequence of stages is adopted; one stage is finished before the next begins:

Preliminary study
Detailed investigation
Model system design
Procurement
Implementation
Maintenance; review; development

A significant deficiency in this methodology is the omission of a formal systems analysis stage following detailed investigation. The views of Collins[4] are interesting in this respect.

This simple linear methodology is sometimes difficult to implement. One finds that 'loops' appear—more often than not quite involuntarily and unforeseen—leading to instability in project development manifested by delays, increased costs, missed targets, spoilt work and sinking morale.

There are three outstanding characteristics of note belonging to this decade. One: the general reluctance of top managers (perhaps one should say top administrators) to identify proper roles for themselves in relation to the use of computers for administrative systems. Two (and this is related to number one): data processing people dominated. They designed and implemented systems *for* the 'user', with more than

a touch of arrogance. Three: by the end of the decade data processing people with other departmental experience were in a minority—hundreds of direct-entry executive officers have been assigned to computer specialisms and as they are promoted their capacity to fill the roles of the data processing people of the 1958–65 era is severely limited by their lack of other experience.

What modest successes we have had in this decade are largely a tribute to that well-known but over-utilized British attribute—the ability to 'muddle through'.

The design strategy throughout this decade tended to be 'bottom-up'. Systems grew from the bottom up until they became too large to escape the attention of top administrators. On the whole senior administrators did not see themselves as systems analysts or designers responsible, like an architect is, for overall design.

Many people, reflecting on this decade, are wondering whether the time is not ripe to abandon or modify the simple linear project methodology, if only because it seems to attract a monolithic design strategy which in many cases has proved difficult and expensive to implement.

Analysis of methodologies for the next decade

Computer-aided administrative systems should be designed to be capable of easy evolution; they should be in a state of continuous creation or evolution. The traditional project methodology does not satisfy this requirement. At best it introduces changes in massive lurches; at worst it fails to introduce changes in time for them to be effective and one is faced with systems ideal for the past but unsuitable for the present.

We must adopt a methodology that, in a sense, does not have a beginning and an end. Systems analysis and design at the highest level must be a continuous activity. There should be a top management group able to perform systems analysis and design in the light of technological developments and the likely future work of the department. A department is a socio-technical system (or combination of systems) and it is for top management to design the total system and plan its evolution. Technological developments in hardware and software are not simplifying these tasks—indeed they are introducing another order of complexity and urgency into the decisions awaiting to be made.

There should be a permanent top management group meeting periodically to up-date its analysis and plans, and review implementations.

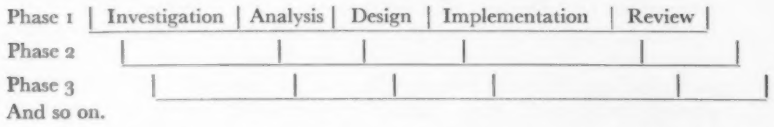
Working to this group may be a number of project managers, appointed to implement various parts of the departmental plan. The essential *modus operandi* would be to phase the analysis, design and implementation of sub-systems to cater for painless organic change. A daunting challenge for top managers. But if we cannot do this then the

alternatives may be either that no institutional changes can be accommodated or that changes can be introduced only in major lurches at great cost.

The need is for a methodology which, when coupled with a suitable design strategy, will produce systems capable of coping with 'transience' in administrative systems.

The real problem

Perhaps the real problem is not the project methodology after all—subject to the changes already ventilated. The real problem may be the system design strategy. Is it possible to design a computer-aided administrative system so that it can be implemented in poly-phase fashion as follows?



Until recently we did not have the technology available to do this satisfactorily, but now we have a choice. There are free-standing minicomputers, hierarchical networks and topological networks (all of them dedicated or shared) in addition to the more conventional configurations of hardware. No longer do we need to send work to a computer centre—the computer facilities can be provided where the work is—via communication lines and terminals. But in networks the computer facilities are also becoming dispersed and eventually may be 'on tap' like electricity. This heralds the invisible computer system. Such a system is bound to change the structure of bureaucratic institutions. As Alvin Toffler says, bureaucracy may well give way to adhocracy, able to cope with the demands of a rapidly changing world, responding quickly to external events.

Conclusion

In a total system sense the process of analysis and design ought to be continuous. What is needed for phased development of sub-systems is a design capability at the very highest level able to conceive the master plan that will permit this to happen. It follows that many top managers, by education, training and career development, will have to be able to relate technology to administrative systems. The Service needs 'systems architects' who can conceive technologically aided administrative systems and are able to define their characteristics in sufficient detail to initiate relevant action. If this conclusion is right then one must question whether the current recruitment, career development and training schemes are likely to produce the kind of person we need.

Postscript

It seems to the author that very few, if any, computer-system and host-

system people are adequately prepared for the kind of high-level systems analysis and design that appears to be needed. Without further action the situation will not improve. Computer-system people are becoming more highly specialized—whereas what is needed is a generalist with advanced education in sociological, organizational and technological subjects. Similarly it does not seem likely that the career development and training of ATs and HEO(A)s will produce such people. Someone somewhere should be planning the career development and training of this important breed of top managers to ensure the future vitality of our administrative institutions.

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2. 'DP People—Who Do They Think They Are?', *Management Services in Government*, February 1975, Volume 30, Number 1, pages 35–40.
3. Computer power varies directly as the cost squared.
4. *The Difference between Systems Analysis and Systems Investigation* by J. H. Collins, University of Lancaster, Eurocomp Conference Proceedings, 1974.

Management Consultants in Government

We have from time to time published lists of management consultancy assignments commissioned by Government Departments. The last such list, covering the calendar year 1974, appeared in the May 1975 edition of MANAGEMENT SERVICES IN GOVERNMENT.

A list of such assignments commissioned during the calendar year 1975 now follows. The list excludes:

(*a*) Assignments in the National Health Service.
(*b*) Computer consultancy (including assistance with computer systems and programming).
(*c*) The employment of consulting staff, whether on secondment from their firms or not, to augment departmental teams.

Department	*Nature of assignment*	*Consultant used*
Cabinet Office	Long-term study of the motor industry	McKinsey & Co. Inc.
Ministry of Defence	Consultancy assistance in the Naval Staff Review	Dickinson Robinson Group Ltd.
Ministry of Defence (Procurement Executive)	Further work on naval materials management study	Inbucon/AIC Ltd.
Department of Employment ..	To advise on the responsibilities of the Board of Executives of Remploy Ltd. and to compare them with those of members of nationalized industries	Hay/MSL Ltd.
Department of the Environment..	Market study of pre-headed containers	Modern Materials Management Ltd.
	To examine the financing of the Central YMCA building project	Coopers & Lybrand Associates Ltd.
	To assist in the introduction of a pilot incentive scheme for industrial staff employed in works services	P-E Consulting Group Ltd.
	Further work on rural lorry users study	PA Management Consultants Ltd.
	To review the method of assessing the fee for the annual 'MOT Test'	Inbucon/AIC Ltd.
Department of Health and Social Security	To conduct a survey on private medical care	Lee Donaldson Associates
	To review and up-date stage III of 1971–72 costing study of pathology laboratories in the National Health Service	Coopers & Lybrand Associates Ltd.
	Stage II of the study of work flow and information within and between local social security offices	Orcon Services Ltd.
	To study information systems in the Department's libraries	Mrs. Aitchison
	To study ambulance service control	Cranfield Institute of Technology
Department of Industry	To study the future survival of Imperial Typewriters	Urwick, Orr & Partners Ltd.
	To undertake a study of the world motor cycle industry	Boston Consulting Group
	A study of remote meter reading systems	Preece, Cardew & Rider Ltd.

Department	*Nature of assignment*	*Consultant used*
Department of Industry—*continued*	Market survey of anti-pollution catalysts	A. T. Kearney & Co. Ltd.
	Study of R & D opportunities in industrial waste disposal	Industrial Aids Ltd.
	To study the market for hydraulic motors	P-E Consulting Group Ltd.
	Market assessment study for machine mounted hammers	P-E Consulting Group Ltd.
	A study of UK industry's need for numerical analysis	Mr. A. J. Garratt and associates
	A study of the British footwear manufacturing industry	Economists Advisory Group
	Supply of edited technological case studies	PA Management Consultants Ltd.
	Listing of Canadian companies with UK investment potential	P. S. Ross & Partners Ltd.
Department for National Savings	To advise on the accounting aspects of a study of the savings certificates system with a view to computerization in the Durham office	Annan Impey Morrish
Scottish Office	To design and implement a quality control system for use in the woodwork shop at Barlinnie Prison	Furniture Industry Research Association
H.M. Treasury	To assist with revised financial information systems for central Government expenditure on Votes	Arthur Andersen & Co.

The Data Base and Its Keeper

P. S. BRAMHILL, Civil Service Department

Peter Bramhill is a lecturer in ADP at the Civil Service College (Specialized Training Wing). —*Editor.*

Introduction

There is a growing awareness among computer specialists and general management that modern data processing techniques demand a regrouping of traditional technical and managerial skills, and the acquisition of some new ones, if the complex socio-technical systems now envisaged are to be brought to fruition successfully. Nowhere is this more apparent than in those ADP projects concerned with the implementation of a data base.

What is a data base? Why is there so much interest among computer specialists in this topic and how are general management involved? Who is a Data Base Administrator? What role should he play in the organization?

Traditional approach to data management

Figure 1 illustrates the traditional approach to the organization of data. The data base is viewed as a pyramid:

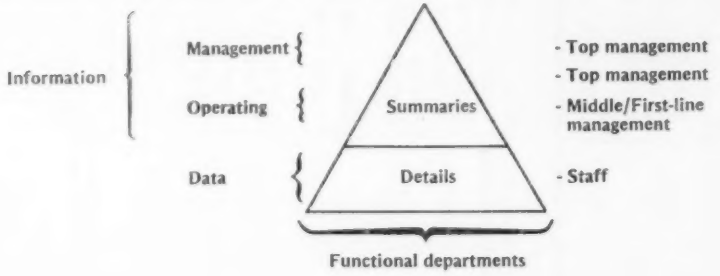

Figure 1

The establishment of a triangular data base is based on the belief that the information needs and requirements of the senior levels of management can be anticipated lower down and that once set up the information systems remains static.

In a computer department which has built a triangular data base the effect of the user changing his requirements leads to a situation where data are locked into a particular ADP system. Data become a frozen asset. The reasons for this are technical, organizational and financial.

In many computer installations the problem is compounded by the effect of machine changes, by poor documentation and the magnitude of redesign costs. Because of poor communications, poor utilization of the computer and the changing needs of the user we reach a paradox where designers of new ADP systems needing to use existing files find it easier to create new files; perhaps extracting the necessary data via special conversion programs. Thereafter our 'data base' exists with redundant data—multiple versions of 'the truth'.

Current interest in data base systems

The topical interest in data base systems comes from two sources. On the one hand there is a technical curiosity from computer specialists concerned with efficient handling of data by the computer. On the other hand the user has realized that data and information are resources which must be controlled, managed and husbanded like any other resource. 'User' is a loose term which covers the group of people, management and staff, who use a computer system but who would not claim to be concerned with the technology.

The user 'owns' the data in the data base, but the computer staff manage the data and are responsible for their safekeeping.

The computer specialist's interest in data base ideas stems from a recent acceptance that the traditional approach to data management is unrealistic in a changing environment. He will tell you that although he aims for this ideal, unchanging situation he cannot often attain it. What he wants is a method of minimizing the upheaval.

In a commercial enterprise a new management team will generate new demands of the information system—perhaps an emphasis on financial reporting where before the emphasis was on selling and marketing. In government a change in the political administration can lead to restructuring of Departments as the machinery of Government is altered. In either situation computer systems under development or operational can be shelved or cancelled with dramatic consequences for the computer department.

It is a fact often overlooked that computer systems exist to serve the needs of a community of users not as an end in themselves. The user, therefore, has an intrinsic interest in the development of computer systems. In the past the user has shied away from too close an involvement in the design process.

The user is just beginning to appreciate that the design problems of the complex socio-technical systems he now wants are as remote from the mundane payroll, stock control and accounting projects of the past as Concorde is from the Wright Flyer.

With increasing awareness of the computer as a machine capable of doing more than the payroll, more managers are realizing that information may be held within existing systems yet remain inaccessible to them. This is because the computer department rarely produces programs quickly enough to satisfy the users' needs.

Functional characteristics of a data base system

The data base concept concentrates our ideas about information, data and storage methods. Most people accept that a data base brings together on computer storage media the data 'owned' by an organization and that the collection fulfils all the data requirements of those who use it.

So far so good, but at this point definitions begin to differ. Our existing collections of punched cards, paper tape, magnetic tape, magnetic discs and the files contained thereon meet the broad definition, but only in a loose sense would they be regarded as a data base by the computer specialist.

The data base is a collection of data, but structured in such a way as to minimize problems of access and usage.

The special computer programs which are needed to provide the structure of the data base are often called a Data Base Management System (DBMS). A DBMS displays certain characteristics which also help to define the data base itself:

1. The heart of an information system is the data from which the information is derived. In a computer based system data are stored on a number of different physical devices and are organized in many quite different ways, logical file structures in the jargon. Because of its generalized nature the DBMS must, therefore, support any of these logical file structures and must not be constrained by the physical storage media.
2. If a number of applications are to use the data and we wish to avoid the problems of data redundancy the DBMS must ensure the integrity and privacy of the data. This means that preferably only one copy of the data is held and it will be guarded against corruption or misuse.
3. It follows that the DBMS must be able to manage the space needed for data storage to use efficiently the available physical storage area.
4. Because we now accept as a fact of life that the requirements of the application change there must be a degree of data independence built into the system. This means that the data base is shielded from the need to change whenever an application program is altered.
5. Because information loses its value over time the data base must respond to a request within an acceptable limit and we should expect all the methods of access to the data base which the DBMS provides to be reasonably efficient, particularly in an on-line computer system.

Data Base Administrator

The data base concept introduces the computer department to some new organizational problems. If a data base is to be installed, structured and supported by a DBMS then some of the tasks normally undertaken by systems analysts or computer programmers will probably be given to the Data Base Administrator (DBA). Why is this?

In an environment where a data base includes data shared by many computer programs it becomes necessary for the data base to be developed centrally. A data base is a compromise between the needs of the various programs. A means of mediating between conflicting demands by the authors of these programs is required and this is the prime responsibility of the DBA. The term 'administrator' is used to emphasize the human activity involved in the performance of this function.

Two topics are of interest:

— the tasks and skills of the DBA
— the organization structure necessary to allow the DBA to function easily.

Tasks and skills of the DBA

The DBA is going to be involved with the initial design of the data base and also with the continuing operation and use of it. The DBA's design tasks can be listed as:

1. Designing a data structure that models the appropriate problem, business or system and can satisfy the data requirements of the data base users.
2. Selecting or specifying and writing the DBMS software to support the data structure.
3. Naming, defining and describing the data items involved in the data structure.
4. Selecting appropriate data-ordering and searching strategies.
5. Organizing data capture, file conversion and restructuring of existing non-data base systems.
6. Privacy controls—assigning passwords and arranging for privacy controls.
7. Data integrity controls—arranging for safeguards against interference between programs which could cause the data to be corrupted.
8. Forecasting additional requirements for extending the scope of the data base.
9. Arranging for the archival storage of data, so that parts of the data base can be off-loaded to low bulk conventional storage media such as magnetic tape or, perhaps, microfilm.
10. Arranging for recovery procedures in the event of computer breakdown.

His responsibility does not end with the successful implementation of

the DBMS, but will continue in the form of quality control, extension and development of the data base.

Most of these tasks are performed already in computer departments, but in a non-data base environment the responsibility for undertaking them is shared between other specialists.

The DBA function may comprise more than one person. It is assumed that the mixture of skills required means that a technical person, probably a software programmer, would be designated DBA although such an individual might be short on the type of skill mentioned in 6 and 7 below. Rarely has the author heard it suggested that a user manager should take the job. A list of the skills and knowledge required is as follows:

1. Knowledge of computer hardware.
2. Practical knowledge of the computer programming languages used in installation.
3. Software programming experience.
4. Applications programming experience.
5. In-depth knowledge of the DBMS.
6. Awareness of political and administrative considerations.
7. Knowledge of corporate goals.

The mixture of technical and non-technical skills is such as to place the DBA job firmly in the technical area of data processing, although at first sight items 6 and 7 might suggest a wider basis for the function.

Organization structures

The organizational structures commonly found in computer departments are based on project groupings (*Figure 2*) or functional groupings (*Figure 3*).

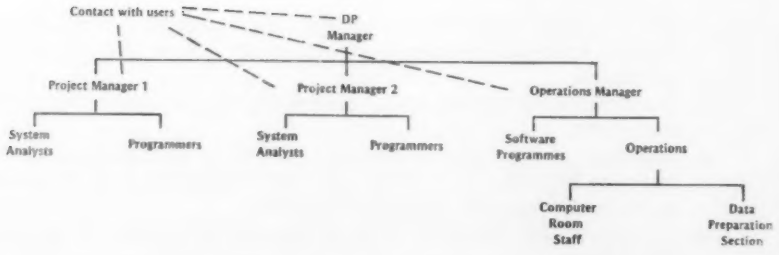

Figure 2 - Project grouping

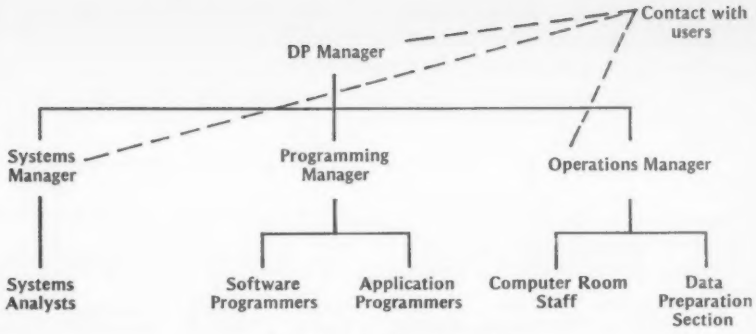

Figure 3 - Functional grouping

Some of the accepted advantages and disadvantages of these organization structures are reviewed in the following table:

	Advantages	*Disadvantages*
Project grouping	1. Communication barriers between analysts and application programmers minimized 2. High level of applications knowledge 3. High morale	1. Project teams may work in isolation from each other 2. The software groups' tendency to regard themselves as an *élite* group of programmers can be increased by separation from the programmers 3. Team size will vary depending on state of project—conflict between 'old' and 'new' members possible
Functional grouping	1. Higher level of specialist knowledge 2. Software and applications programmers interact 3. Easier to schedule staff—can be moved from job to job 4. Contact with users channelled to selected group managers	1. Communications barrier between functional groups 2. Lack of commitment to a 'project' by individuals

In practice many installations mix these two forms of organizational structure hoping to get the best of all worlds.

How does the DBA fit into the structure? Clearly his terms of reference, tasks and responsibilities impact on all the technical managers in the computer department. The DBA's position holding the key to the data base makes him as potentially powerful a figure as the

DP manager, although one must remember that in practice these organization structures are accommodated within the normal Civil Service grading pattern. A suggested organization is shown at *Figure 4*.

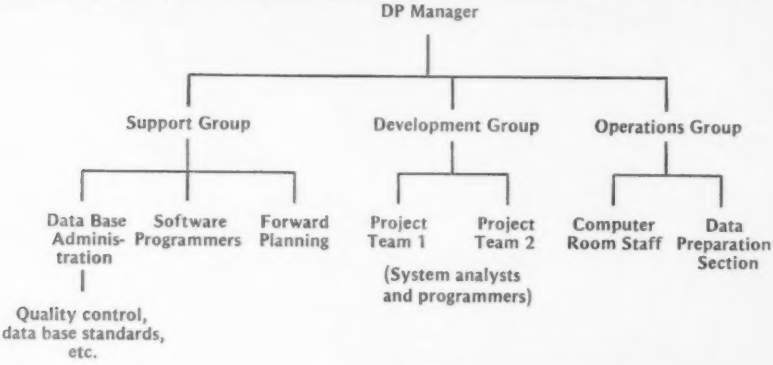

Figure 4

It should be noted that this form of organization has included the DBA in a support area orientated towards serving the other areas of the computer department. There is no suggestion that he liaises with the user directly. Implicit too is the assumption that there is a large number of ADP staff.

Summary

What then is a data base? It is a collection of related data organized in such a way that present and future users can access it with the minimum of disturbance to themselves or to the computer department.

A data base is normally managed by a Data Base Management System (DBMS), a collection of special computer programs which must be capable of:

1. Setting-up the data base.
2. Storing and retrieving data in response to requests from user programs.
3. Efficiently managing the data base storage area.
4. Providing for data base changes.
5. Providing for restoration of the data base should an error occur.

Implicit in all of these requirements is the need to retain data integrity and privacy.

The Data Base Administrator is the human manager charged with the overall control of the data base. As such he performs a highly technical function within a specialist department. Organizational changes will probably occur within a computer department large enough to give the DBA function separate existence. The DBA job absorbs and centralizes some of the tasks previously undertaken by systems analysts, computer programmers and data processing management.

Project Network Technique

Two Simple Methods of Resource Allocation

F. OFFLER, Civil Service Department

Fred Offler is Course Director in Project Network Technique at the Civil Service College (Specialized Training Wing). In the article that follows he describes two methods of resource allocation which he designed and which are now taught at the College. —*Editor.*

Introduction

It has been said, and I think it is quite a reasonable assumption to make, that two-thirds of all networks do not go beyond the stage of time analysis. Undoubtedly such networks are valuable in that, by their very discipline, they force planning to be done logically and in depth. But the real value of Project Network Technique is the savings that can be made by the proper allocation of resources, and one wonders why this part of the technique is so often sadly neglected—until one looks at the various methods of teaching resource allocation. I am sure that most people have found the popular methods confusing to the extent of anathematizing the technique. Perhaps another factor is that we do not invest enough labour in the control of networks even though it can be shown that, where PNT is used to the full, considerable savings are generally effected.

This article aims to show that there are simple methods of resource allocation, so simple, in fact, that project support staff with little or no knowledge of network techniques could do the job—once they had mastered the procedures explained below.

It is realized that when such a procedure is spelled out in detail it can look formidable and for this reason a summary of the procedure is presented before the detailed version. Those who have a working knowledge of network techniques will readily appreciate its simplicity and the more detailed explanation which follows may be found useful for training purposes.

Summary of the procedure

The activities are arranged in tabular form in ascending order of total float, within groups which, themselves, are arranged in order of start. Where two or more activities in the same group have the same amount of total float, these activities are arranged in ascending order of duration.

A time-scaled bar chart is prepared showing activities starting in an order of precedence determined by the sum of the Earliest Start Time and the total float of the activity; the activity with the lowest sum takes

precedence over all others, provided it starts at, or later than, its Earliest Start Time and the resources it requires, when added to resources already committed, do not exceed the resource ceiling.

Detailed explanation of the procedure

There are two methods of determining precedence: one by annotating the tabulation to show a decreasing total float; the other by means of a specially prepared template. Both methods are described in detail.

Method 1—By decreasing value of total float

The project (*see Figure 1*)

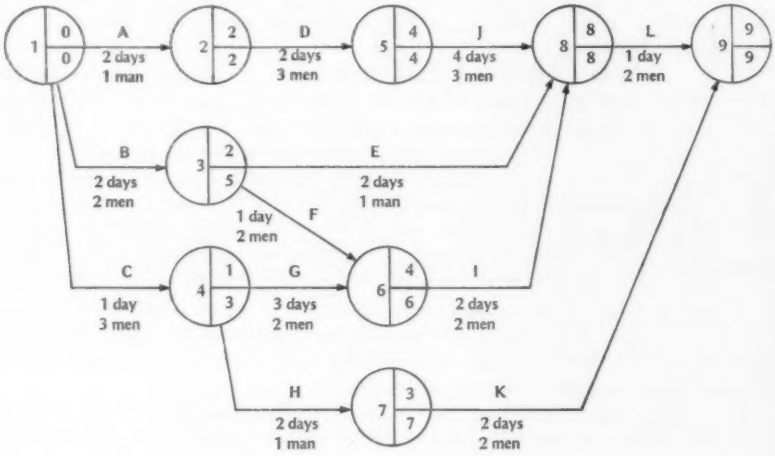

Figure 1

(*a*) *The logic*

Activities A, B and C are start activities; when A is complete D can start; activities E and F can start when B is complete; G and H can commence when C is complete; J follows D; I may be started when both G and F are complete; when H is complete K may begin; activity L follows the completion of activities E, I and J; activities K and L are end activities.

(*b*) *Activity durations* (*days*)

A = 2	C = 1	E = 2	G = 3	I = 2	K = 2
B = 2	D = 2	F = 1	H = 2	J = 4	L = 1

(*c*) *Resource requirements* (*men*)

A = 1	C = 3	E = 1	G = 2	I = 2	K = 2
B = 2	D = 3	F = 2	H = 1	J = 3	L = 2

(*d*) *The first step*

The first step is to draw a network showing the durations of the activities and the resources required to complete those activities.

(*e*) *The second step*

We need to know the total man-days for the project (see (*h*) below). We find this by summing the products of each activity's duration and resource requirement.

Activity	Duration	Resources	Man days
A	2	1	2
B	2	2	4
C	1	3	3
D	2	3	6
E	2	1	2
F	1	2	2
G	3	2	6
H	2	1	2
I	2	2	4
J	4	3	12
K	2	2	4
L	1	2	2
			Total 49

(*f*) *The third step*

We need to know the various start and finish dates of the activities together with their respective values of free and total float.

CP	Activity		Duration	EST	LST	EFT	LFT	Float	
	Tail Event	Head Event						Total	Free
*	1	2	2	0	0	2	2	0	0
*	2	5	2	2	2	4	4	0	0
*	5	8	4	4	4	8	8	0	0
*	8	9	1	8	8	9	9	0	0
	1	4	1	0	2	1	3	2	0
	4	6	3	1	3	4	6	2	0
	6	8	2	4	6	6	8	2	2
	1	3	2	0	3	2	5	3	0
	3	6	1	2	5	3	6	3	1
	4	7	2	1	5	3	7	4	0
	7	9	2	3	7	5	9	4	4
	3	8	2	2	6	4	8	4	4

* Activities in the critical path.

(*g*) *The fourth step*

The next step is to prepare a tabulation with the activities arranged in ascending order of duration, within an ascending order of float,

which, in turn, is in an ascending order of start date. On the right-hand side a vertical double line indicates when an activity can start and horizontal double lines separate groups of activities by order of start. To the right of the vertical double line, a decreasing series of numbers is inserted, in pencil, starting with the number one less than the figure in the float column. (*See Figure 2.*)

DAY	ACT	ACTIVITY TAIL EVENT	ACTIVITY HEAD EVENT	MEN	DUR	FL'T	0	1	2	3	4	5	6	7	8	9
							1	2	3	4	5	6	7	8	9	
1	A	1	2	1	2	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	
	C	1	4	3	1	2	1	0	-1	-2	-3	-4	-5	-6	-7	
	B	1	3	2	2	3	2	1	0	-1	-2	-3	-4	-5	-6	
2	G	4	6	2	3	2		1	0	-1	-2	-3	-4	-5	-6	
	H	4	7	1	2	4		3	2	1	0	-1	-2	-3	-4	
3	D	2	5	3	2	0			-1	-2	-3	-4	-5	-6	-7	
	F	3	6	2	1	3			2	1	0	-1	-2	-3	-4	
	E	3	8	1	2	4			3	2	1	0	-1	-2	-3	
4	K	7	9	2	2	4				3	2	1	0	-1	-2	
5	J	5	8	3	4	0					-1	-2	-3	-4	-5	
	I	6	8	2	2	2					1	0	-1	-2	-3	
9	L	8	9	2	1	0									-1	
	RESOURCES REQUIRED															

The figures in the time scale columns should be entered, lightly, in pencil.

Figure 2

(*h*) *The final step*

The final step is to smooth, or level, whichever is required: the procedure is the same for both (see next paragraph). To ascertain at which level smoothing should start, divide the man-days (see second step) by the project duration. In this example, divide 49 by 9. If the quotient contains a fraction it should be rounded up to the next whole number—which, for this example, means that we should start smoothing at six men.* This formula is valid in most instances, but it may be found necessary to increase the smoothing figure where the resource requirements of a single activity, or the sum of the resource requirements of two concurrent activities, exceeds the formula figure. If we are restricted to a specific number of men (levelling), say, for example, 5, we need to estimate the probable duration of the project which we do by dividing the man-days by the resource ceiling—e.g. $\frac{49}{5}$, and once again, rounding up. This will indicate the minimum duration of the project under resource constraints and it is advisable to allow a few more days beyond this estimate.

The algorithm shown in *Appendix A* (or the logical prose instruction in *Appendix B*) should be followed until smoothing, or levelling, is complete. The solutions are shown in *Appendix C*.

Method 2—By a specially prepared template

(*a*) *Steps 1 to 3* are the same as for Method 1.

(*b*) *The fourth step*

The next step is to prepare a tabulation with the activities arranged in ascending order of float, which, in turn, is in an ascending order of start date. On the right-hand side a vertical double line indicates when an activity can start and horizontal double lines separate the groups of activities by order of start.

(*c*) *The fifth step*

The next step is to prepare a template such that each line on the template registers with the appropriate line on the tabulation. (*See Figure 4.*)

The first column on the template shows the sum of the Earliest Start Time and the total float of the activity concerned. The arrows indicate dependencies on other activities: each dependency should be shown separately. In the procedure which follows, when the start of an activity is being considered, a check is made to ascertain whether the activity is dependent upon the completion of another activity (such a dependency is indicated by the presence

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* In both smoothing and levelling cognizance should be taken of constraints by logic. For example, in the following network

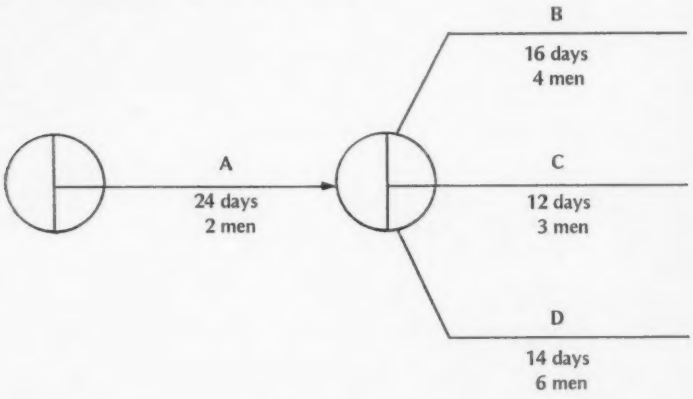


Figure 3

smoothing or levelling above two men could not start until day 25 because of the logic constraint of activity A.

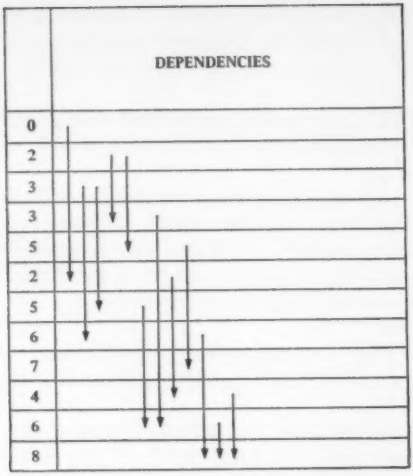


Figure 4

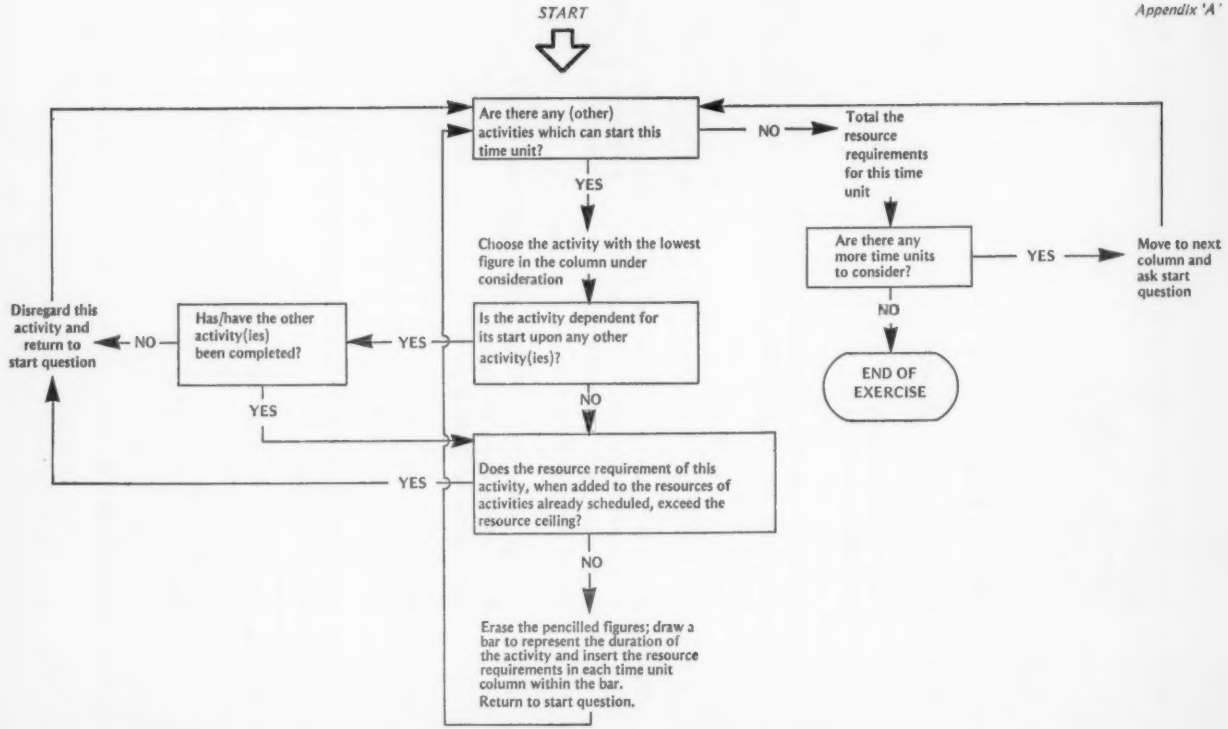
of an arrowhead on the same line on the tabulation as the activity being considered) and by following the arrowshaft back to its origin one can ascertain whether the preceding activity has, in fact, been completed.

(*d*) *The final step*

As with Method 1 each day is examined, in turn, and activities started according to the order of precedence which is determined, in this instance, by the lowest figure in the first column of the template of those activities which may start on, or before, the day under consideration. To ascertain this precedence the template is cut along its leading edge. The template is laid over the tabulation so that the leading edge is in line with the right-hand edge of the column of the day being considered.

The algorithm shown in *Appendix D* (or the logical prose instruction in *Appendix E*) should be followed until smoothing, or levelling, is complete. The experienced operator will be able to smooth and level by use of the template alone and without recourse to the use of the algorithm. The solutions are the same as those for Method 1 and shown in *Appendix C.*

The author acknowledges that the solutions are not unique.


START
Are there any (other) activities which can start this time unit?
NO
Total the resource requirements for this time unit
YES
Choose the activity with the lowest figure in the column under consideration
Are there any more time units to consider?
YES
Move to next column and ask start question
NO
END OF EXERCISE
Is the activity dependent for its start upon any other activity(ies)?
YES
Has/have the other activity(ies) been completed?
NO
Disregard this activity and return to start question
YES
NO
Does the resource requirement of this activity, when added to the resources of activities already scheduled, exceed the resource ceiling?
YES
NO
Erase the pencilled figures; draw a bar to represent the duration of the activity and insert the resource requirements in each time unit column within the bar.
Return to start question.

Step 1. Are there any (other) activities which can start this time unit?
Yes—move to Step 2.
No—move to Step 8.

Step 2. Choose the activity with the lowest figure in the column under consideration.
Move to Step 3.

Step 3. Is this activity dependent for its start upon any other activity(ies)?
Yes—move to Step 6.
No—move to Step 4.

Step 4. Does the resource requirement of this activity, when added to the resources of activities already scheduled, exceed the resource ceiling?
Yes—move to Step 7.
No—move to Step 5.

Step 5. Erase the pencilled figures relating to this activity; draw a bar to represent the duration of the activity and insert the resource requirements in each time unit column within the bar.
Move back to Step 1.

Step 6. Has/have the other activity(ies) been completed?
Yes—move back to Step 4.
No—move to Step 7.

Step 7. Disregard this activity.
Move back to Step 1.

Step 8. Total the resource requirements for this time unit.
Move to Step 9.

Step 9. Are there any more time units to consider?
Yes—move back to Step 1 relative to the next column being considered.
No—This is the end of the exercise.

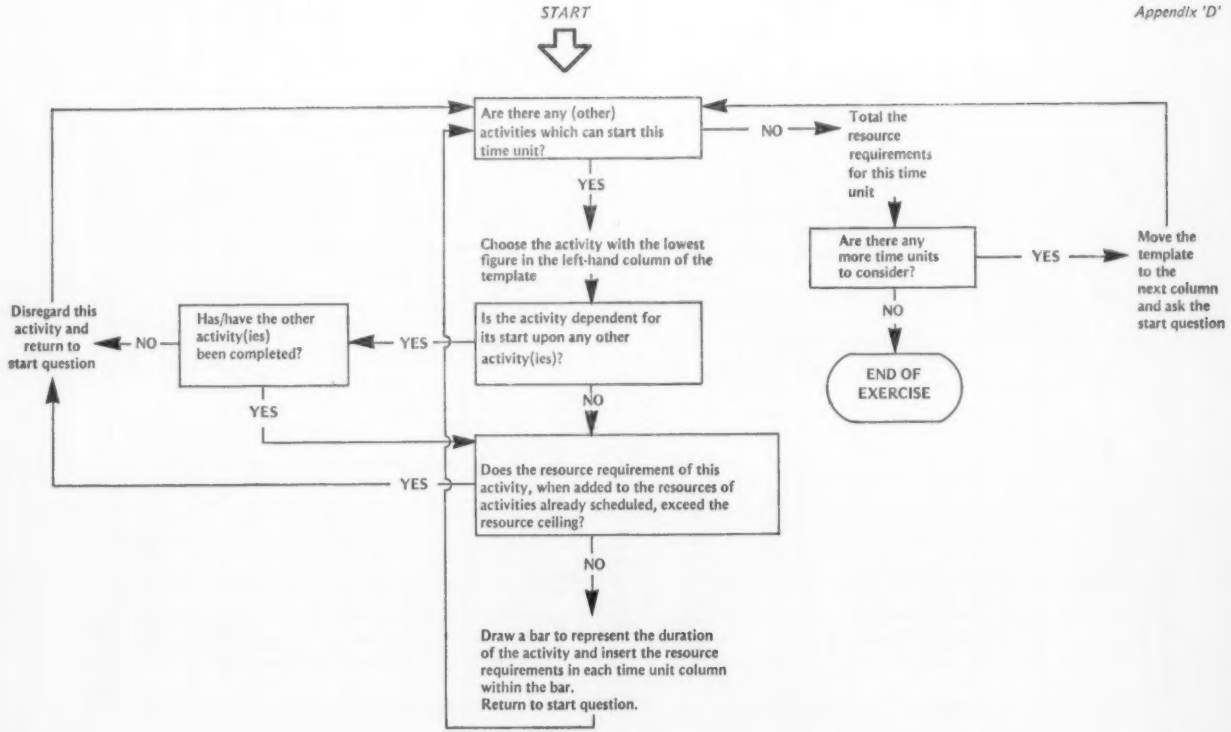
SMOOTHING SOLUTION

DAY	ACT	ACTIVITY TAIL EVENT	ACTIVITY HEAD EVENT	MEN	DUR	FLT	0	1	2	3	4	5	6	7	8	9
							1	2	3	4	5	6	7	8	9	
1	A	1	2	1	2	0	1	1								
	C	1	4	3	1	2	3									
	B	1	3	2	2	3	2	2								
2	G	4	6	2	3	2		2	2	2						
	H	4	7	1	2	4		1	1							
3	D	2	5	3	2	0			3	3						
	F	3	6	2	1	3					2					
	E	3	8	1	2	4				1	1					
4	K	7	9	2	2	4								2	2	
5	J	5	8	3	4	0					3	3	3	3		
	I	6	8	2	2	2						2	2			
9	L	8	9	2	1	0									2	
RESOURCES REQUIRED							6	6	6	6	6	5	5	5	4	

LEVELLING SOLUTION

DAY	ACT	ACTIVITY TAIL EVENT	ACTIVITY HEAD EVENT	MEN	DUR	FLT	0	1	2	3	4	5	6	7	8	9	10	11
							1	2	3	4	5	6	7	8	9	10	11	
1	A	1	2	1	2	0	1	1										
	C	1	4	3	1	2	3											
	B	1	3	2	2	3		2	2									
2	G	4	6	2	3	2		2	2	2								
	H	4	7	1	2	4			1	1								
3	D	2	5	3	2	0					3	3						
	F	3	6	2	1	3				2								
	E	3	8	1	2	4							1	1				
4	K	7	9	2	2	4									2	2		
5	J	5	8	3	4	0							3	3	3	3		
	I	6	8	2	2	2					2	2						
9	L	8	9	2	1	0											2	
RESOURCES REQUIRED							4	5	5	5	5	5	4	4	5	5	2	

A more symmetrical solution to the resource level may be obtained by exchanging the positions of the bars of activities "E" and "K".


START
Are there any (other) activities which can start this time unit?
NO
Total the resource requirements for this time unit
YES
Are there any more time units to consider?
YES
Move the template to the next column and ask the start question
NO
END OF EXERCISE
Choose the activity with the lowest figure in the left-hand column of the template
Is the activity dependent for its start upon any other activity(ies)?
YES
Has/have the other activity(ies) been completed?
NO
Disregard this activity and return to start question
YES
NO
Does the resource requirement of this activity, when added to the resources of activities already scheduled, exceed the resource ceiling?
YES
NO
Draw a bar to represent the duration of the activity and insert the resource requirements in each time unit column within the bar.
Return to start question.

Step 1. Are there any (other) activities which can start this time unit?
Yes—move to Step 2.
No—move to Step 8.

Step 2. Choose the activity with the lowest figure in the left-hand column of the template.
Move to Step 3.

Step 3. Is this activity dependent for its start upon any other activity(ies)?
Yes—move to Step 6.
No—move to Step 4.

Step 4. Does the resource requirement of this activity, when added to the resources of activities already scheduled, exceed the resource ceiling?
Yes—move to Step 7.
No—move to Step 5.

Step 5. Draw a bar to represent the duration of the activity and insert the resource requirements in each time unit column within the bar.
Move back to Step 1.

Step 6. Has/have the other activity(ies) been completed?
Yes—move back to Step 4.
No—move to Step 7.

Step 7. Disregard this activity.
Move back to Step 1.

Step 8. Total the resource requirements for this time unit.
Move to Step 9.

Step 9. Are there any more time units to consider?
Yes—move back to Step 1 relative to the next column being considered.
No—this is the end of the exercise.

Computer Audit in the Civil Service

P. W. COOMBES, Civil Service Department

Peter Coombes is in C.2 Division, Central Computer Agency, CSD. The article that follows is based on a paper presented to the Heads of Internal Audit in Government Departments seminar held on 16th December 1975. —*Editor.*

In 1972 the Civil Service Department Computers Committee established an inter-departmental working group to consider central Government's computer audit requirements. One of the working group's recommendations was that the Central Computer Agency (CCA) should produce standard, authoritative information and guidance on computer audit for accounts, stores and computer staff in Departments. As a result of the working group's recommendation CCA produced, in consultation with the Management Services (Accountancy) Division (MS(Acc)) of Civil Service Department and the Computer Group of Exchequer and Audit Department, the publication *Audit of Computer Systems in Central Government—Part I.* Part I was published in March 1975 and more than 2,000 copies have been distributed. CCA holds a stock and copies are available to Government Departments on request.

In order to monitor the production of the Guide, a Working Group on Computer Audit was formed by representatives from the Computer Group of Exchequer and Audit Department, MS(Acc), CSD, and Audit Section, CCA.

It meets regularly and, although originally convened to consider the Guide, it now serves as a forum for discussing matters relating to the internal and external audit of computer-based financial systems in Government.

Since work on the Guide commenced the Working Group has concluded that computer audit should embrace:

(*a*) The audit of financial systems run on computers, including the output arising from them.
(*b*) A review of the security and control of a computer installation.
(*c*) A review of the information on which the management decision to procure a computer is based.
(*d*) A check on the physical existence and use of computers procured.

Part I is intended to provide guidance to Departments on the use of the computer as an audit tool. It recommends that auditors should use the computer as an audit tool because of the significant improvements in the quality of the audit of a computer-based system which

can be derived. Other recommendations are that audit staff should participate to a greater extent in discussions on new computer-based systems at the system design stage and that extensive use should be made of interrogation packages. It recognizes, however, that interrogation packages cannot successfully access many of Government's computer files and that purpose written programs are sometimes necessary. Indeed, in some situations purpose written programs may be better, for example, because of efficiency. When copies of Part I were distributed comments on it were invited and several helpful suggestions have been received.

The level of audit involvement envisaged in Part I cannot be accomplished without proper training in computer audit. The programme of training recommended by CCA and MS(Acc), CSD is a one-week *Introduction to Computer Systems for Auditors* course followed after a break of about eight weeks by a two-week *Audit of Computer Systems* course. Both courses are organized on behalf of the Civil Service College by Kingston Polytechnic. Every auditor whose work brings him into contact with computer-based systems should attend these courses. At present there are three of each course each year.

Part II of *Audit of Computer Systems in Central Government*, which is about the controls required in computer installations, for example, administrative controls, is now being prepared and should be distributed by mid-summer 1976. A new idea in Government that will be advocated in Part II is that internal auditors should audit computer system feasibility study reports. Such an audit could range from an arithmetical check of costs and savings to an overview of whether all relevant facts have been taken into account in the report or whether the estimates and timescales are reasonable. The audit should be carried out at the same time as the report is sent to CCA for approval and within the same timescale.

Part II will also indicate the need for an occasional physical check of the computing equipment at an installation. It is management's responsibility to ensure that there is a regular check of all equipment. Audit should ensure that such a check is carried out and should occasionally perform a test check themselves.

Appendix A to Part II will contain an amended version of the computer audit internal control questionnaire (ICQ)* circulated by CCA in March 1974. Several Departments submitted comments on the format and content of the ICQ and these will be incorporated in the revised version. During 1975 CCA promulgated a standard procedure for the development of central Government ADP standards and codes of practice (Central Government Standard No. 7). The procedure, which involves the formation of a working group of representatives from Departments, will be used to develop a standard computer audit

* An ICQ is a check-list of questions designed to review the system of internal control in force and to highlight any weaknesses.

ICQ for Departments during 1976. Departments will be invited to nominate representatives to serve on a working group early in 1976.

Production of Part II will not complete the work on *Audit of Computer Systems in Central Government*. There will still be room for additions and improvements. Additions we already have in mind include chapters on frauds, data bases, networks and mini-computers. Hopefully, improvements will be suggested by users and all suggestions are welcome.

Publication of Parts I and II is not the end of CCA help. Guidance will be followed by on-the-spot advice, especially in relation to the use of interrogation packages. Help with the audit problems of new technology, especially ICL 2900 series computers, will be provided.

Training is an important matter. Not only should more auditors attend the basic computer audit courses but also more advanced computer audit courses, for example, audit problems of data bases, could with advantage be arranged. It is also important that higher management should be made generally aware of the nature of the audit function in relation to computer-based systems, and the problems which may arise. CCA are considering ways of helping with these issues. Consideration is also being given to the possibility of a quarterly computer audit newsletter to Departments, perhaps as a section of an audit newsletter to be produced by CSD. The purpose of the newsletter would be to notify Departments of important developments which arise from time to time.

The need for specialized training and expertise raises the question of whether the three years, on average, spent in internal audit by generalist civil servants is enough. Three years is hardly sufficient to train an internal auditor. Computer auditors take longer to train and further time must be spent in internal audit if the Department is to benefit from the training given. Therefore, should a longer period, say, at least five years, be spent in internal audit? Should some civil servants with special aptitude be asked to spend their careers on finance work including internal audit? Should there be a career structure for accounts staff?

These points demonstrate that there is much yet to think about and to do. In short, publication of *Audit of Computer Systems in Central Government* is not the end, it is only the beginning.

The Central Computer Facility

R. A. BALLARD, Civil Service Department

Ron Ballard is a Senior Principal Scientific Officer in the Central Computer Agency (CCA). In the article that follows he describes the role of the Central Computer Facility (CCF) which has been set up in CCA to evaluate ICL's (International Computers Limited) new range of computers and assist Government projects to introduce it into their systems. The article was first published in *Computing*.—*Editor*.

It seems to be in the nature of computers that, whoever the manufacturer and whatever the quality of the products, early customers have to bear the brunt of any teething troubles. The UK Government is a major purchaser of ICL equipment for its administrative systems in a large number of departments. On the introduction of the ICL 2900 series it was therefore decided to try to avoid the situation in which separate installations acquiring machines in the series would individually have to tackle fundamentally similar problems.

The Central Computer Agency (CCA) therefore arranged to acquire the first customer model 2970 and apply it on behalf of departments in advance of their own 2900 deliveries. The installation is much more than a bureau for program development. A comprehensive centre has been created, reflecting CCA's general responsibilities in addition to facilitating the smooth introduction of departmental systems. This is the Central Computer Facility (CCF).

It is the CCA's responsibility to advise and assist Government computer projects at all stages of procurement, implementation and operation. By taking special steps to acquire the 2970 as early as possible CCA has provided itself with the means of acquiring the training and experience essential to fulfil this requirement in respect of the new ICL machines.

As a result CCF is able to appraise machine and software facilities and performance, advise and assist Government Departments on their particular applications and provide the machine time for their program development. It will establish standards and codes of practice, undertake simulation, modelling and sizing, assess and measure system performance, help with program conversion, and provide operator and operation management training.

In its composition CCF is an interesting amalgam of computing interests. The facility is under the direct management of the CCA but its technical and operations staff have been recruited not only from CCA but from other Government Departments, ICL and a number of

software houses. The staff brought in from the software industry in general specialize in systems software design and development, providing experience which cannot be readily made available from within the Government service without penalty to existing installations. Staff from other departments will return to their parent installations after spells of up to two years with the CCF, during which time they will have become highly competent in aspects of 2900 computer systems and will, therefore, be most valuable in the introduction of these computers at their own sites.

The underlying idea behind the Facility was that experience should be available centrally at the earliest date to aid the introduction of the 2900 range into Government installations. This demanded that an early model be made available for this purpose. Location of the installation at ICL's own premises at Bracknell was dictated by the need to take this early delivery and the difficulty of finding suitable accommodation quickly. Significant advantages for both CCF and the company unquestionably flow from the close working contacts with the ICL development and operation personnel—certainly at this stage in development.

ICL has provided generous access to design documentation, to development results and to the design and implementation teams themselves. As a result CCF has not had to duplicate the form of testing and validation of the systems software carried out by the company. Validation can be confined to tests which drive the software in a manner similar to that expected by the individual user projects in the field. This leads in turn to the need to develop methods for creating appropriate environments so that many of the problems usually first encountered at the field site will now be identified and overcome during the controlled experiments carried out at Bracknell.

To give meaningful advice, CCF must have a real awareness of the requirement of Government projects. Close association has therefore been established with early 2900 projects and in some cases personnel from these have already joined CCF. CCF specialists may work alongside the installation implementation teams in their departments.

During the early days of the range, machine time will be in great demand. The Bracknell machine will therefore be used by prospective Government installations for program and systems testing before they get their own equipment. In the main, access will be via remote job entry terminals.

Rationalizing existing standards and codes of practice and developing new ones particularly relevant to the 2900 will be carried out in cooperation with other users of the range. Where possible, standards adhering closely to present Government practice will be evolved and maximum use will also be made of those developed by ICL itself. Experimental work will be carried out with the specific objective of establishing codes of practice for efficient and good use of the software—for example, with programming languages, to identify those constructs

most efficiently mapped upon the machine and those that ought to be avoided.

Any organization with large computing commitments is faced with a difficult task in assessing requirements for both new equipment and enhancements, particularly where operations involve large bureau-type multi-programming processing. CCA's annual expenditure on all computers of some £20 million is a very large commitment in which ultimately the 2900 could figure largely. For this reason techniques to measure and optimize actual performance of the 2900 series, and to provide simulation and modelling techniques aids to be used by Government projects and methods of sizing operational requirements in terms of 2900 components, are being investigated.

System acceptance is another subject under investigation by CCF in so far as the ICL new range is concerned. The problem, essentially, is to be satisfied that the equipment has sufficient capacity to perform its task in a particular project environment given that, at the time of acceptance, the application system is not usually available. Synthetic benchmarks may be useful; but if all projects were required to build a true benchmark this would represent a very large commitment in work. CCF is in a position to minimize this by establishing a library of programs which may be assembled into a benchmark representative of the appropriate application.

Because of the Government's present commitment to ICL current range machines, effective conversion will be a major operation. It is part of the CCF's responsibility to give aid on this, assessing the installation requirement and providing guidance on the techniques and methods most appropriate in the particular circumstances of each project.

One of the difficulties which faces any installation on delivery of new equipment is the provision of field experience for the operations staff. Government installations will be able to send their operations staff to the CCF to work alongside that installation's operators and in this way obtain first-hand experience.

The Central Computer Facility is a new development in central Government which should significantly benefit Government's computing activities. With its supporting specialists it should help installations overcome many difficulties much more speedily than would otherwise be the case and so avoid the degrading of operations in the early days of a new system.

Exploration in Management

A Review by D. N. TANNER

The subject of consultation and participation on the part of workers in executive decision-making is a theme which springs to mind as being more than topical in contemporary society; and there are many who believe that the economic survival of this country depends to a considerable extent on the success of schemes for mutual collaboration between the managed and the managers. So a series of six colour films, as part of a training package entitled *Exploration in Management*, describing ways in which practical methods of improving industrial relations and also company performance, with special emphasis on worker participation in decision-making, is something that today's 'student' of industrial relations cannot miss seeing, especially when the object lessons are distilled from nearly 40 years of successfully applied managerial experience at Glacier Metal under the benign guidance of Wilfred Brown.

Lord Brown, and the Glacier Institute of Management which was established to pass on the practical lessons learned at Glacier Metal, have produced a training package, including an excellent series of six colour films describing, in case history form, what the Institute perceives as good industrial relations' practice, including the design of a framework or system in which employee participation in management policy and decision-making can occur—without too much friction, so that more light than heat is generated.

Technically well produced and directed, and realistically acted, with an apposite commentary from Wilfred Brown, the films portray, against an industrial engineering factory background, the full play of human characteristics, anxieties, weaknesses and leadership styles, of executives, shop floor workers and trade union officials faced with the awesome prospect of change—in this case the new-fangled worker participation scheme change, which, prima facie, will help the company outstrip its competitors and survive economically.

The total training package comprises the six half-hour films (in video cassette or 16 mm versions) and includes a comprehensive tutor's guide which enables managers without too much teaching or tutoring experience to make the most beneficial use of the package. But Glacier Metal Institute will provide training in the use of the package, which is of four days' duration. Particulars of the training package, and the four-day training course for tutors, may be obtained from the Operations Manager, the Glacier Institute of Management Limited, 17 King Edward's Road, Ruislip, Middlesex (Telephone: Ruislip (71) 74158).

Recently, a 30-minute summary film of the six-film series has been produced.

One of the difficulties that faces those attempting to improve the performance of largely administrative organizations, particularly in the area of human relations, is that of relating management literature and case study material which is largely based on industrial situations. Partly because each of the six films in this package deals with a simple and easily understood situation, partly because the tutors' guide for group discussion encourages students to examine their own organization and its problems against the background of that portrayed in the films, and partly because, after all, human psychology is a common denominator, the process of building bridges between industrial situations portrayed in these films and the administrative situation should not be too difficult.

Book News

FLEXIBLE WORKING HOURS

By Heinz Allenspach. *Published by the International Labour Office, Geneva, price 17·50 Swiss Francs (paperback)*

This is a useful slim volume which describes FWH in clear terms and sketches a brief history (from 1967) with references to key literature. Various kinds and degrees of flexibility are discussed, against the background of legislation which limits the length of the working day. Common terms ('core time', 'credits', etc.) are defined and used. Examples are given of the attendance rules in force in various undertakings.

Apart from the main technical treatment, there is a brief consideration of the advantages and difficulties associated with FWH. Advantages are seen for the work force, for management, and for the economy as a whole (in regard to easing traffic difficulties, for example). Potential problems (relating to work organization, shift work and overtime arrangements, the need for attendance recording) are dealt with briefly. The overall impression is one of optimism, that FWH form part of '. . . management designed to adapt work to the natural pace of the worker's daily life, so that instead of an external constraint, imposed by the need to earn a living, work may become a means of self-fulfilment for the individual'.

H. F. H.

CLERICAL QUALITY CONTROL

By D. C. Arnall and T. S. Hall. *Published by The Institute of Administrative Management, price £2·50*

The need to require complete accuracy from office staff is questioned in the book *Clerical Quality Control* which has recently been published.

The book first describes how the existing 'error situation' in one or more office processes may be analysed, first by filling up a series of errors analysis sheets (one of which is illustrated in the book), then by breaking down the information so obtained into elements. Additional factors such as office output, working conditions and pressure of work are then taken into consideration in assessing likely causes of the errors detected, as well as their incidence and seriousness.

An errors analysis exercise using the techniques outlined is described in some detail, and the information so provided further analysed and interpreted with reference to one particular office routine and the filling in of a claim payment order form in an insurance company. The same form, revised in the light of errors in its use disclosed by the errors analysis exercise, is illustrated as well as the original form.

The second part of the book describes how the situation revealed by an error analysis exercise may be remedied, first by defining acceptable standards according to the three classifications of vital, important or minor; then by tackling the causes of errors, whether they are those of principle (in which case the remedies are job training, job cards, the appointment of quality control officers, and the return of inaccurate work) or of omission, carelessness or illegibility, for all of which remedies are suggested by the authors.

Checking techniques are then described under the headings of sample checking (both commonsense and scientific); statistical quality control; acceptance sampling; and full checking. A number of control charts used in statistical quality control are also illustrated. Valuable advice on the use of coding—alphabetic, numerical, significant and non-significant—to detect error is given in the appendix.

Letter to the Editor

The views expressed in letters to the Editor are the writer's own, and not necessarily those of his Department.

Dear Editor,

I see that my account of MbO in the Department of Education and Science that appeared in the August edition of *MSIG* has recently been reviewed by *Anbar*. The abstract correctly reports two beneficial effects of the installation—improved appreciation of managerial responsibilities and better communications—but goes on to say that there was 'a greater degree of harmful effects, including an increase in staff,

excessive paperwork, difficulties in setting quantifiable objectives, and disenchantment with a "tiresome irrelevance" '. This gives rather the wrong impression, I am afraid, and out of fairness to the staff at Darlington and to any of your readers who may also have seen the abstract I would like to set the matter right.

First, the increase in staff during the course of the installation was due solely to the substantial increase in work caused by extensive changes in the teachers' superannuation scheme and was in no way caused by MbO. Indeed, during the course of the MbO installation groups of the staff themselves identified organizational changes that could lead to staff savings—for example, by an increase in the clerical/executive staffing ratio.

Second, it was the pressure on the Branch caused by the new legislation that, not unnaturally, caused some disenchantment during the early stages of the installation. But this was a temporary state of affairs and few of the staff would now regard their new management style as a tiresome irrelevance.

Third, there certainly was excessive paperwork in the system put in by the consultants, but this was soon recognized both by the Branch and by Management Services, and from the first review onward the procedures have been progressively simplified. Indeed the system as a whole has been gradually refined by the Branch to take account of its own particular circumstances, and although to the purist the 'installation' may not now show some of the classic signs of MbO there is nevertheless an improved management style that the Branch regards as its own. This is surely an indication of success.

There should be no surprise at the difficulty in establishing quantifiable objectives; it has all along been regarded as an occupational hazard with MbO in the Civil Service. That we found it so in Pensions Branch, where on the face of it there WAS some hope of quantifying objectives, merely underlines the point.

Finally, as an ex-Management Services man now, may I add a purely personal, and somewhat heretical, postscript. My own view at the outset was that a rigid package, neatly labelled MbO (with capital letters), would be likely to get in the way of the acceptance of the essential philosophy of management by objectives (without the capital letters). To achieve more effective management it seemed that if we needed a package at all it was better to end up with the client's own personally wrapped parcel than to start with someone else's.

This is in fact what happened, and it leads me to wonder whether, within the management field as a whole, we have created too many 'techniques', each of which inevitably demands the support of specialists and disciples. I think perhaps it is time to ask the question 'WHY' about some of them.

Yours sincerely,

D. M. BASEY
Department of Education and Science

Computer Installations for Government Departments

A list of all Government computers as at 1st January 1975 was published as a supplement to the May 1975 edition of MANAGEMENT SERVICES IN GOVERNMENT. Details of computers ordered during the period July to September 1975 are shown in the following table.

DATE OF ORDER	DEPARTMENT	LOCATION	MAIN USES	MANUFACTURER* AND TYPE OF COMPUTER
1B Computers on order for administrative and general purposes				
July 1975	Export Credits Guarantee	Cardiff	Insurance invoicing and statistics; information retrieval	IBM 370/135
July 1975	Paymaster General's Office	Crawley	Pension payments, banking	ICL 2970
July 1975	National Savings	Lytham St. Annes	Premium Savings Bonds and Stocks	Interscan 2100
August 1975	Defence (Navy)	Portsmouth	Stock control	ICL 1904S
September 1975	Inland Revenue	Cumbernauld	PAYE, Schedule D, etc. assessing	ICL 2970
September 1975	Defence (Army)	Blandford	Soldiers' pay and statistics	DEC PDP 10
September 1975	Industry	Eastcote	Bureau service	ICL 1904S
September 1975	Public Records Office	Kew	Statistics and requisitioning system	DG Nova 2/10
2B Computers on order for scientific and technical purposes				
July 1975	Procurement Executive	Bath	Computer-aided ship design	DEC PDP 11/50
August 1975	Procurement Executive	Fort Halstead	General scientific computing	DEC PDP 8E
September 1975	Environment	Watford	Building research	ICL 1904S

*Manufacturer Key (*Column* 5)

DEC	Digital Equipment Co. (UK) Ltd.
DG	Data General Corporation USA
IBM	International Business Machines (UK) Ltd.
ICL	International Computers Ltd.
Interscan	Interscan Data Systems (UK) Ltd.

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